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Felicia Mureșanu and Voichița Has and Mircea Ignea

Agricultural Research and Development Station Turda , Agricultural Research and Development Station Turda , Agricultural Research and Development Station Turda

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# SOME ELEMENTS OF ECONOMIC EFFICIENCY OF BIOLOGICAL TREATMENT TO COMBAT CORN BORER (*OSTRINIA NUBILALIS* HBN) IN THE CONDITIONS OF TRANSYLVANIA

FELICIA MUREȘANU<sup>1</sup>, VOICHIȚA HAȘ<sup>2</sup>, MIRCEA IGNEA<sup>3</sup>

**Abstract:** The paper is a synthesis of the results obtained during 1998-2010, on the effectiveness of biological (*Trichogramma* spp.) and chemical treatments (different insecticides) in reducing the attack of *Ostrinia nubilalis* Hbn. to the corn genotypes created at The Agricultural Research and Development Station Turda. Among *Trichogramma* species used, a good efficacy in reducing attack of *Ostrinia nubilalis* was presented by *T. maidis* (80.0 %) and *T. evanescens* (78.0 %) - 3 applications. The applications with these species of *Trichogramma* to maize crops should be done at a distance of 6-7 m / row and between rows, in order to allow a uniform dispersion and a high degree of parasitizing eggs of corn borer. The biological treatments with *T. maidis* made to corn hybrids created at SCDA Turda, had reduced significantly the corn borer attack, recording production increases from 4.0 to 11.0 %. The basic conditions for achieving high efficiency in reducing the attack of *Ostrinia nubilalis*, with *Trichogramma* spp. are: conducting applications at optimal moment and ensuring optimum densities correlated with the density of the pest and chemicals used (*Decis Mega 50 EW*, *Calypso 480 SC*) had reduced the attack frequency significantly and very significantly, their efficacy in this regard was between 87-90 %. From the analysis performed through the economic effect of biological and chemical treatments to combat corn borer (*Ostrinia nubilalis*) resulted certain economic advantages using the method of biological control with *Trichogramma* spp., both in terms of reducing costs per hectare and the production growth produced. Thus, the species of this entomophage used, *Trichogramma* spp., constitutes in a way a "new generation of biological insecticides", that does not pollute and is used to combat the over 500 species of pests in the order *Lepidoptera*.

**Key words:** *Trichogramma* spp., *Ostrinia nubilalis* Hbn., biological treatments, economic efficiency.

## INTRODUCTION

In the maize crop, due to not complying with the crop hygiene measures, application of incomplete or incorrect crop technologies, it creates optimal conditions for maintaining of an old pest, but in actuality, corn borer (*Ostrinia nubilalis* Hbn.) in crops over the economic limit of damage. In the recent years, an increasing of population of this pest occurred, recording in many areas of Transylvania (west, northwest, centre of the country), an attack from 27.1 to 97.3%, which resulted in direct damages, by significantly reducing of the productive potential, and indirect, by breaking and fall of plants, appearing diseases as: Fusarium, blight and mechanical harvesting is performed with great difficulty; this information has been received from the farmers in those areas.

To combat this pest, or reduce pest populations below the economic threshold of damage (ETD), "the integrated management of plant protection" must accompany us, which means: selective methods of protection, increasing the role of agro-technical and biological measures, permanent control of hazardous agents and keeping them under ETD, environmental protection and conservation of biodiversity in nature. Under the pressure of pollutants, not complying with the crop hygiene measures, the integrated control concept is required, consisting, in this case, in using of *Trichogramma* spp. (MUREȘAN, 2000; 2001; ÖZTEMİZ et al., 2001 FURLAN, 2001) and of different selective products for useful fauna (PONS et al., 2000; VOS, 2004). This paper is a synthesis of the results obtained in a long time period (1998-2005), on the effectiveness of biological (*Trichogramma* spp., biological products) and chemical treatments (different insecticides) in reducing attack of *Ostrinia nubilalis* Hbn. to corn genotypes created at SCDA Turda.

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<sup>1</sup>PhD Eng. MUREȘANU Felicia, SR I, Agricultural Research and Development Station Turda, e-mail: [diabrotica22@yahoo.com](mailto:diabrotica22@yahoo.com)

<sup>2</sup>PhD Eng. HAȘ Voichița, SR II, Agricultural Research and Development Station Turda

<sup>3</sup>Eng. IGNEA Mircea, SR III, Agricultural Research and Development Station Turda

## MATERIAL AND METHOD

At SCDA Turda in interdisciplinary collaboration between breeders and entomologists have been addressed a number of researches on the behaviour of various corn hybrids at borer attack, in the crop of genetic improvement (GIs), contest comparative crops (CCC) and orientation comparative crops (OCC).

Studies and research carried at SCDA Turda referred to:

- the influence of biological treatments with *Trichogramma maidis* on the attack of *Ostrinia nubilalis* and production of maize genotypes created at SCDA Turda; were used 10 corn hybrids (Elan, Turda 200, Turda 200 Plus, Turda Super, Turda SU182, Turda SU 210, TurdaMold.188, Turda Favorit, Turda 165, Turda 201) in three repetitions, each with two variants: untreated control and three applications with *T.maidis*, dose of 200 000 pieces / ha, administrated fractionated (50 000 + 100 000 + 50 000; a variant size was 14 square meters.;

- efficacy of the biological and chemical treatments in reducing the attack of *Ostrinia nubilalis* Hbn; for this aspect, the experiment consisted of 6 variants in 3 repetitions, according to the method of randomized blocks, the variant size being 14-square meters; the biological treatments were carried out with *T.maidis*, *T. evanescens*, *T. dendrolimi*, the launching dose being 200 thousand pieces / ha, divided doses: first release -50 000, the second - 100 000 and the third -50 000 pieces / ha; the chemicals with the products Decis Mega 50 EW in dose of 0.25 l / ha and Calypso 480 SC in dose of 0.15 l / ha.

Both chemical and biological treatments have been applied starting with the occurring of the first adults of corn borer registered at sex pheromone traps, repeating every 8 days. The observations made have been related to the frequency of the attack of *Ostrinia nubilalis* and production obtained, which were carried out at harvest.

Calculation methods used were: chi-square test (X<sup>2</sup>) and analysis of variance. *Trichogramma spp.* biological treatments were analyzed in terms of their economic effect compared with chemical treatments with the product Calypso 480 SC.

## RESULTS AND DISCUSSIONS

At the 10 maize hybrids created at Turda, after 3 applications with *Trichogramma maidis*, the corn borer attack was significantly and very significantly reduced, depending on the hybrid tolerance to pests (Fig. 1). Reducing attacks, were obtained significant production increases (Elan, Turda 200, Turda 165), distinctly significant (Turda SU 182, Turda 201) and very significant at Turda SU210 and Turda Favorit. (Fig. 2).

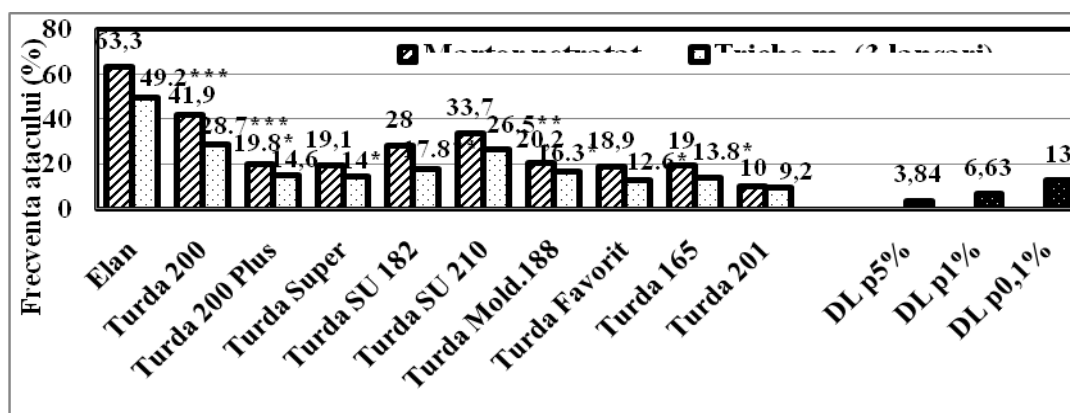


Fig. 1. The effect of treatments with *Trichogramma maidis* on the frequency of the attack of *Ostrinia nubilalis* Hbn. at maize genotypes created at SCDA Turda

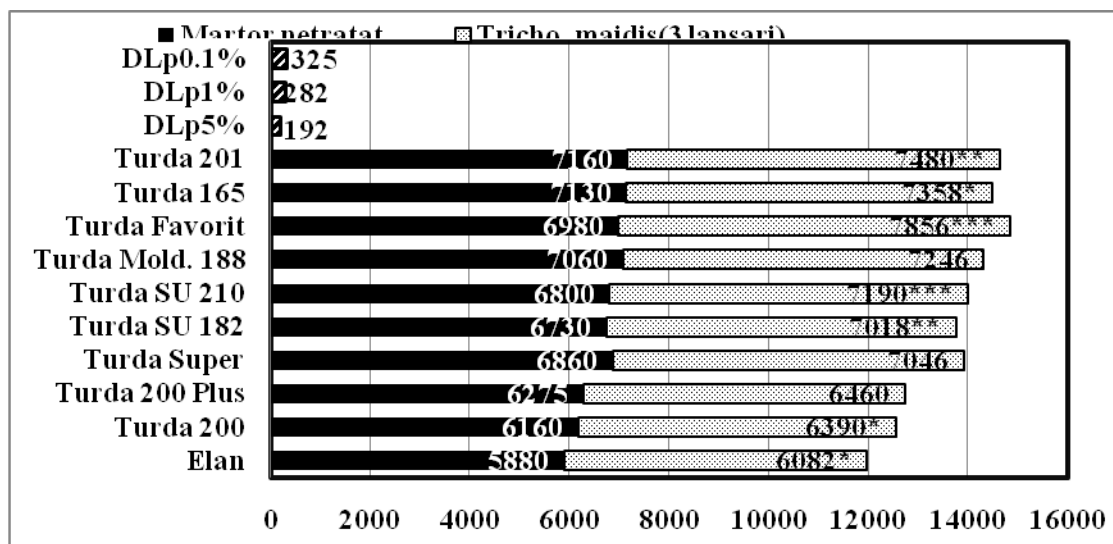


Fig. 2 The effect of treatments with *Trichogramma maidis* on the production obtained at maize genotypes created at SCDA Turda

The corn borer attack was significantly and very significantly reduced also after chemical treatments with the products Decis Mega 50 EW and Calypso 480 SC (from 59.6% at untreated control to 39.5 and 33.4% respectively). Very significant reduction was recorded at the biological treatments with the three species of *Trichogramma*: *T.maidis* very significant, *T.evanescentis* distinct significant and *T.dendrolimi* distinct significant, depending on the species of *Trichogramma* specific for the pest to be controlled; in our case for the corn borer - *Ostrinia nubilalis*, *T. maidis* then *T.evanescentis* were more appropriate.

Reducing the attack was confirmed by reducing the length of galleries from plants, which in the case of treatments with *T. maidis* were very significantly reduced (from 9.5 cm to 2.7 cm), the non-existence proof of corn borer larvae, the egg being parasitized by the parasite before the larvae hatching. (Fig.3). Production increases were obtained in the variants treated with Decis Mega 50 WG product (0.25 l / ha) and Calypso 480 SC (0.15 l / ha), significant and very significant, compared to the untreated control (2, 6 to 7.0%). (Figure 4).

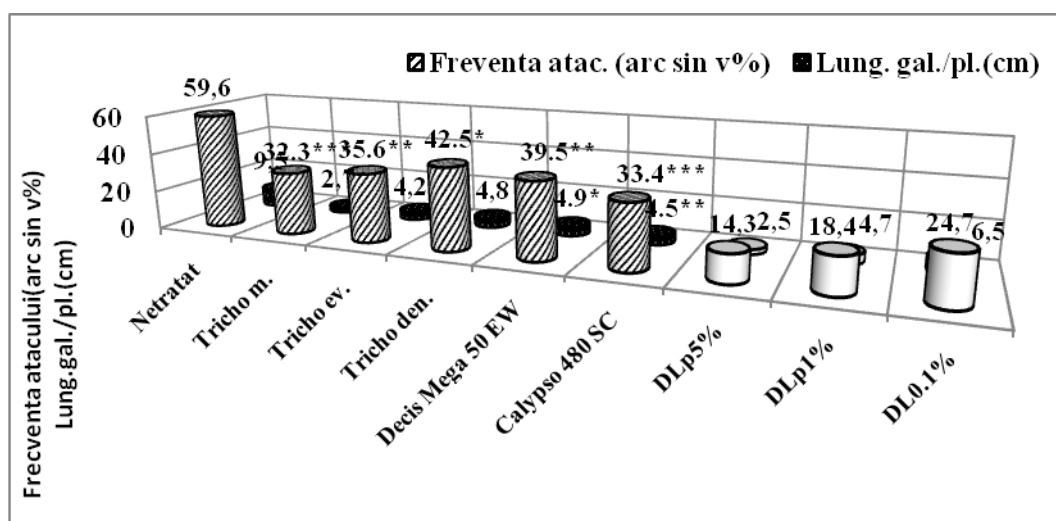


Fig. 3 The influence of biologic and chemical treatments on the attack frequency (%) of *Ostrinia nubilalis* Hbn. and of the lengths of galleries (cm) in the corn plants

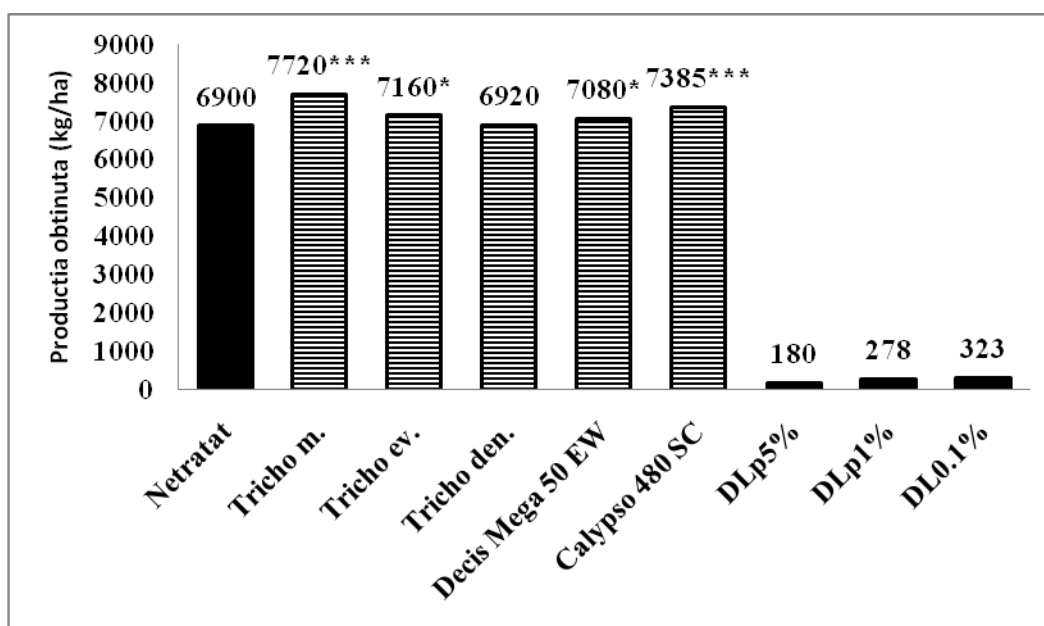


Fig.4. The effect of biological and chemical treatments on the production obtained (kg/ha) at SCDA Turda

From the economic calculation made based on the results obtained in maize crop experiences with the method of biological control, the parasite *Trichogramma spp.* and the chemical method with the insecticide Calypso 480 SC, at cost of 2012, resulted in certain economic advantages in using the method of biological control, both in terms of reducing costs per hectare and production of the production growth realized. Thus, total expenditures incurred by biological treatment were 1.124 lei / ha, representing 51.3% compared to chemical treatment, the costs for this treatment being 2.190 lei / ha. (Table 1).

Table 1

Costs with the method of combating per hectare / variants

Method of combating	Expenses/ha/technological sequence			Total lei	
	Mechanized works (lei)	Manual works (lei)	Materials and supplies (lei)		
Biological	-	198	926	1.124	-
Chemical	328	62	1800	2.190	1.066

Also, the effect of biological control to combat corn borer, materializes through the achieved production growth, compared to chemical control; this production increase obtained is justified compared to chemical treatment with the insecticide mentioned, because the pest does not reach in the corn stalk and / or cob, because the parasite *Trichogramma* destroys the pest egg before the larvae hatch and enter the corn plant. (Table 2).

Table 2

The effect of treatments on the grains production for an average production of 4000 kg/ha

Method of combating	Production gain (%)	Returns in absolute production gain (kg/ha)	Average absolute production gain obtained (kg/ha)		Average value of the production gain obtained (lei/ha)	
Biological	3,2 – 12,5	228-876	552	220	6.072	2.420
Chemical	2,6 -7,0	180-485	332	-	3.652	-

According to calculations resulted that by the biological treatment, the quantity and value of production obtained is superior to that obtained by chemical treatment, which is materialized by

220kg/ha, ie 2,420 lei / ha; is recommended to use entomophagous treatment where possible, resulting in certain economic benefits and more.

## CONCLUSIONS

Among the species *Trichogramma* used, a good efficiency in reducing the attack of *Ostrinia nubilalis* was presented by *T. maidis* (80.0%), followed by *T. evanescens* (78.0%) - 3 applications. The applications with entomophagous in the maize crops should be carried out at a distance up to 8 m / row to enable an uniform dispersion and a high degree of pest.

- Biological treatments with *T.maidis* performed at the corn hybrids created at SCDA Turda, have reduced very significantly the corn borer attack, recording production increases from 3.2 to 12.5% at most hybrids, and after chemical treatments with the products mentioned the production increases were significant, but with lower values (2.6-7.0%) than after biological treatments.

- Basic conditions for achieving high efficiency in reducing *Ostrinia nubilalis* attack, with biological method, respectively *Trichogramma spp.* are: currently conducting applications at the proper moment and ensuring optimum densities correlated with the density of the pest.

- The total expenditures incurred by biological treatment were reduced very significantly compared to those with chemical treatment, resulting also that, by the biological treatment, the quantity, quality and production value obtained is greater than that obtained by chemical treatment; besides the economic benefits, the application of entomophagous in different agro biocenosis for 3-4 consecutive years, lead to their accumulation in those agrobiocenosis, thus changing the ratio with the pests to combat in their favour, managing that populations pest to be controlled and kept below the economic threshold of damage.

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